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EXAMINER	
WEINSTEIN, LEONARD J	

ART UNIT	PAPER NUMBER
3746	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/771,843	ZAISER ET AL.	
	Examiner	Art Unit	
	LEONARD J. WEINSTEIN	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 November 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3,9-15,19-24,27,33-39,43-58,60,62,63,65,66 and 68* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3,9-15,19-24,27,33-39,43-58,60,62,63,65,66 and 68* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the Amendment of November 26, 2010 ("Amendment"). In making the below rejections and/or objections the examiner has considered and addressed each of the applicant's arguments.

2. The examiner acknowledges the amendments to claims 15, 39, 49, 54.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 3, 9-11, 15, 19-21, 33-35, 39, 43-45, 49-58, 60, 62, 63, 65, and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey, II et al. US 5,988,165 ("Richey") in view of Muratsubaki et al. US 6,068,448 ("Muratsubaki '448"), further in view of Muratsubaki et al. EP 1162372 ("Muratsubaki '372"), stil further in view of Coffield US 5,354,361.

a. Independent **Claims 15 and 49**

i. **Combination of Richey and Muratsubaki '488 – Motor**

(1) **Richey** - Richey teaches all the limitations for a multistage pump for pressurizing a volume of fluid including:

[claims 15 and 49]

a controller (circuitry for compressor 100 shown in figures 4 and 5) in communication with a drive system 105 of a pump/compressor 100 that initiates a piston cycle (piston cycle of pistons 131, 132, and 133) by initiating a compression stroke in a first piston 131 in response to the detection of predetermined pressure within a chamber (buffer tank 200) which corresponds to the pressure in a first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5);

(2) **Muratsubaki '448** – Richey does not teach the pump arrangement of a rotatable ball screw nut 14 engaged with the threaded portion 13 and a reversible motor as taught by Muratsubaki '448 for a multistage pump for pressurizing fluid including:

[claims 15]

A housing (10A, 10B, 11) having a first cylindrical chamber 12A and a second cylindrical chamber 12B, the first chamber 12A having a first inlet 32 and a first outlet (34/44), the second chamber

12B having a second inlet (34/46) and a second outlet 36, the second inlet (34/46) of the second chamber 12B being in communication with the first outlet (34/44) of the first chamber 12A, a first piston 13A positioned within the first chamber 12A to define a first piston chamber 12A, a second piston 13B positioned within the second chamber 12B to define a second piston chamber 12B the volume of the first piston chamber 12A being larger than the volume of the second piston chamber 12B (col. 9 ll. 62—col. 10 ll. 12), a connecting member (13, 14) for securing the first and second pistons (13A, 13B) together in a spaced apart manner along a common axis (as shown in figure 1), and extending between the first and second chambers (12A, 12B), the connecting member (13, 14) including a threaded portion 13, a drive system (14, 21, 22) for reciprocating the first and second pistons (13A, 13B) in unison within the first and second piston chambers (12A, 12B) such that when the first piston 13A is moving in an expansion stroke, fluid is drawn into the first piston chamber 12A through the first inlet 32, and at the same time, the second piston 13B is moving in a compression stroke where fluid is expelled from the second piston chamber 12B through the second outlet 36, and when the first piston 13A is moving in a compression stroke, the second piston 13B is moving in an expansion stroke where fluid is

expelled from the first piston chamber 12A through the first outlet (34/44) and into the second piston chamber 12B through the second inlet (34/46) where the fluid is compressed due to the reduced volume of the second piston chamber 12B (col. 9 ll. 62 - col. 10 ll. 12), the drive system (14, 21, 22) including a rotatable ball screw nut 14 engaged with the threaded portion 13 and a reversible motor 21 for alternately rotating the nut 14 in opposite directions to cause reciprocating linear translation of the connecting member (13, 14) and pistons, and a check valve system (42, 44, 46, 48) for maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36; and

[claim 49]

A housing (10A, 10B, 11) having an input line 18 for receiving a fluid and an output line 72 for delivering the fluid (col. 9 ll. 62 – col. 10 ll. 12), a first piston 13A operable in an expansion stroke and a compression stroke in a first piston chamber 12A in the housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 in fluid communication with the input line 18 and a first outlet (34/44), wherein during the expansion stroke fluid flows into the first piston chamber 12A through the first inlet 32 and during the compression stroke the fluid is forced out through the first outlet (34/44), a second piston 13B operable in an expansion stroke and

a compression stroke in a second piston chamber 12B in the housing (10A, 10B, 11), the second piston chamber 12B having a second inlet (34/46) in fluid communication with the first outlet (34/44) of the first piston chamber 12A and a second outlet 36 in fluid communication with the output line 72, wherein the second piston chamber 12B has a smaller volume than the first piston chamber 12A (col. 9 ll. 62 – col. 10 ll. 12), wherein during the expansion stroke fluid is drawn into the second piston chamber 12B through the second inlet (34/46) and during the compression stroke the fluid is forced out through the second outlet 36, a connecting member (13, 14) securing the first piston 13A and the second piston 13B together in a spaced apart manner along a common axis, as shown in figure 1, the connecting member (13, 14) having threads (as defined on element 13) along a portion of its length, a ball screw drive system (14, 21, 22) in communication with the threads (as defined on element 13) on the connecting member (13, 14) for reciprocating the connecting member (13, 14) such that when the first piston 13A is in an expansion stroke, the second piston 13B is in a compression stroke, and when the first piston 13A is in a compression stroke, the second piston 13B is in an expansion stroke;

(3) **Motivation for combination:** Muratsubaki '448 teaches a pump that is used to create a high pressure by routing a volume of fluid from one chamber where fluid is pressurized by a first piston traversing through a chamber in a compression stroke, to a subsequent second chamber where a second piston that is linked to the first piston traversing through the second chamber in an expansion stroke. When the compression stroke of the first piston is completed a reversible motor drives the first and second piston assembly in a second direction so that the second piston conducts a compression stroke and fluid within the second chamber is pressurized for a second time to a high pressure. Muratsubaki '448 teaches that this method of fluid pressurization eliminates unneeded fluid circulation that can lower the quality of the fluid being pumped or compressed, and reduce the time it takes for fluid to reach a target pressure (Muratsubaki – col. 2 ll. 43-51).

Richey is directed toward a method and apparatus for forming oxygen enriched gas to be store at a high pressure in a mobile storage unit (Richey – Abstract). An objective of Richey is to be able to store high purity oxygen in a pressure vessel using a compressor with a series of pistons that compress a fluid with a first piston which then travels to a chamber of a subsequent piston to be

further compressed. Richey utilizes a labyrinth of fluid passages that are used to transport fluid from one piston chamber to the next.

It is noted that in Richey the expansion stroke of each piston does not correspond directly to the compression stroke of any other piston. Muratsubaki '448 minimizes any lost motion of a first piston by using its expansion stroke to further pressurize a fluid volume through its linkage with the second piston. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an apparatus and method of pressurizing a volume of fluid, as taught by Richey, with a fluid pump in which a piston assembly with two piston heads is reciprocated by a reversible motor such that the expansion stroke of one piston corresponds the compression stroke of the second piston, as taught by Muratsubaki '448, in order to reduce the risk of negatively affecting the quality of fluid pumped while being able to pressurize the fluid to a desired pressure quickly and more efficiently by minimizing the lost motion of a pumping member (Muratsubaki '448 – col. 2 ll. 43-51).

ii. **Combination of Richey, Muratsubaki '448, Muratsubaki '372 – Variable Speed Motor:**

(1) **Muratsubaki '372** - A combination of the references teaches the limitations as discussed but fails to teach a variable speed

motor as taught by Murasukai ‘372 for an apparatus including a pump for pressurizing a volume of fluid including:

[claims 15 and 49]

A drive system (fig. 1) including a reversible motor 7 (analogous to the servo motor 21 of Muratsubaki ‘448; reversible per Muratsubaki ‘372 - ¶ [0065]) driving a dual piston pump 1 to reciprocate along a linear path to reciprocate a connecting member (connection between elements 5A and 5B within element 1) and pistons (5A, 5B) wherein the reversible motor 7 has a variable rotational speed (Muratsubaki '372 - ¶ [0067]-[0070]);

(2) **Motivation for combination:** The plunger pump 10A of Muratsubaki ‘448 is equivalent to the plunger pump 1 of Muratsubaki ‘372. The pumps operate in a similar manner with the exception that the pump of Muratsubaki ‘372 does not teach a valve arrangement that constructively provides an intensifier as taught by Muratsubaki '448. The modification proposed would leave the pump and valve arrangement of Muratsubaki '448 as applied to Richey unchanged but the motor and control of Muratsubaki ‘448 would be substituted and expanded by the variable speed motor 7 and proportional control module 25 of Muratsubaki ‘372.

Muratsubaki '372 teaches detecting a pressure value in a nozzle in a suspension state and operating a plunger pump at a

maximum rate to quickly raise the actual pressure in the nozzle to a preset value and then continuing to operate the plunger pump at an optimum rate to maintain the pressure value at or very close to the preset value (Muratsubaki ‘372 - ¶ [0027]). This provides a similar advantage as Muratsubaki '448, however in that pump a threshold pressure can be reached quickly but the speed of the motor driving the pump cannot be varied continuously to maintain the pressure level dynamically as taught by Muratsubaki ‘372 (Muratsubaki ‘372 - ¶ [0068]).

In Richey, while a pressure in the buffer tank is not below a threshold level, the pump is operated until the pressure in a cylinder reaches a threshold high pressure level and then the pump is turned off (Richey - col. 11 ll. 38-45). A modification in which the low pressure cut-off switch of Richey was maintained but the variable speed motor of Muratsubaki ‘372 was substituted in, and the proportional control module for maintaining a high pressure by varying the speed of a variable speed motor was added to the control of Muratsubaki ‘448 that senses a piston’s position, would teach the limitations as claimed. With this modification once the high pressure level in the cylinder was reached in Richey, just as when the desired pressure is reached in Muratsubaki '372, the control will operate the motor at an optimum rate to maintain that

pressure. One of ordinary skill in the art would have found it obvious at the time the invention was made to modify an oxygen concentrator with a mobile oxygen storage unit, as taught by Richey, by substituting a compressor with an intensifier, as taught by Muratsubaki '488 and discussed above, further modified by expanding a control and substituting a motor with a proportional control module and variable speed motor respectively, as taught by Muratsubaki '372, in order to provide a system that could quickly provide fluid at a desired pressure in a storage cylinder and dynamically maintain the pressure in the cylinder by modulating the speed at which the motor drove the intensifier (Muratsubaki '372 - ¶ [0027], [0068]).

iii. **Combination of Richey, Muratsubaki '372, Murasubaki '488, Coffield – Fluid Path Arrangement Within Housing:**

(1) **Coffield** - A combination of the references teaches the limitations as discussed but fails to teach the fluid connection between a first chamber and a second chamber within a housing that are taught by Coffield for an apparatus including a pump for pressurizing a volume of fluid including:

[claims 15 and 49]

a dual piston pump (48, 49) having a passage 56 for receiving fluid form a first outlet 53 of a first piston chamber 42 and a second

piston chamber 43 having a second inlet 59 in fluid communication through the passage 56 with first outlet 53 of the first piston chamber 42, wherein during a compression stroke of a second piston 49 in the second piston chamber 43 fluid is forced out through a second outlet 61 to an outlet line 63;

(2) **Combination** –

(a) Where a claimed improvement on a device or apparatus is no more than "the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for improvement," the claim is unpatentable under 35 U.S.C. 103(a). *Ex Parte Smith*, 83 USPQ.2d 1509, 1518-19 (BPAI, 2007) (*citing KSR v. Teleflex*, 127 S.Ct. 1727, 1740, 82 USPQ2d 1385, 1396 (2007)). Wherein if applicant claims a combination that only unites old elements with no change in the respective functions of those old elements, and the combination of those elements yields predictable results; absent evidence that the modifications necessary to effect the combination of elements is uniquely challenging or difficult for one of ordinary skill in the art, the claim is unpatentable as obvious under 35 U.S.C. 103(a). *Ex Parte*

Smith, 83 USPQ.2d at 1518-19 (BPAI, 2007) (*citing KSR*, 127 S.Ct. at 1740, 82 USPQ2d at 1396.

(b) Coffield teaches it was known in the art at the time of the invention to use a dual piston intensifier pump in an oxygen concentrator of the type taught by Richey and disclosed. Coffield teaches that the dual piston pump is used as a pressure booster to provide gas at a desired higher pressure (Coffield - col. 1 ll. 13-43). A combination of the references already constructively teaches an intensifier pump with Richey which teaches smaller pump chambers in series with each other, however the chambers are not provided in the same section of a housing as taught by the dual pump of Coffield. It would have been obvious to one ordinary skill in the art at the time the invention was made to provide a connection between a first and second chamber with the same section of housing of pump and connect the outlet of chamber to the inlet of the other chamber to provide a dual piston intensifier capable of supplying gas at elevated pressures since it was well known in the art to provide these types of pumps and pumping connections for oxygen concentrators.

(3) Accordingly, since the applicant[s] have submitted no persuasive evidence that the combination of the above elements is uniquely challenging or difficult for one of ordinary skill in the art, the claim is unpatentable as obvious under 35 U.S.C. 103(a) because it is no more than the predictable use of prior art elements according to their established functions resulting in the mere application of a known technique to a piece of prior art ready for improvement.

b. **Claims 39 and 54**

i. **Combination of Richey and Muratsubaki '488 – Motor**

(1) **Richey** - Richey teaches all the limitations for a method of compressing a volume of fluid including the steps of:

[claims 39 and 54]

Initiating piston cycle (piston cycle of pistons 131, 132, and 133) by initiating a compression stroke in a first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8) from a controller (circuitry for compressor 100 shown in figures 4 and 5) in communication with a drive system 105 in response to the detection of a predetermined pressure within the first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5);

(2) **Muratsubaki '448** – Richey does not teach the specific structural components of a ball and nut screw motor used to perform a method of pressurizing a volume of fluid that are taught by Muratsubaki '448 and including the steps of:

[claim 39]

Operating a first piston 13A within a first cylindrical chamber 11A defining a first piston chamber 12A in a housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 and a first outlet (34/44), operating a second piston 13B within a second cylindrical chamber 11B defining a second piston chamber 12B in the housing (10A, 10B, 11), the volume of the first piston chamber 12A being larger than the volume of the second piston chamber 12B (col. 9 ll. 62 – col. 10 ll.12), maintaining the first and second pistons (13A, 13B) secured together in a spaced apart manner along a common axis with a connecting member (13, 14), the connecting member (13, 14) including a threaded portion (as defined by the threaded portion of element 13), reciprocating the first and second pistons (13A, 13B) in unison within the first and second piston chambers (12A, 12B) with a drive system (14, 21, 22) such that when the first piston 13A is moving in an expansion stroke, fluid is drawn into the first piston chamber 12A through the first inlet 32, and at the same time, the second piston 13B is moving in a compression stroke

where fluid is expelled from the second piston chamber 12B through the second outlet 36, and when the first piston 13A is moving in a compression stroke, the second piston 13B is moving in an expansion stroke where fluid is expelled from the first piston chamber 12A through the first outlet (34/44) and into the second piston 13B chamber 12B through the second inlet (34/46) where the fluid is compressed due to the reduced volume of the second piston chamber 12B, the drive system (14, 21, 22) including a rotatable ball screw nut 14 engaged with the threaded portion (thread portion of element 13) and a reversible motor 21 for alternately rotating the nut 14 in opposite directions to cause reciprocating linear translation of the connecting member (13, 14) and pistons (13A, 13B) – (col. 10 ll. 34-50), and maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36 with a check vane system (42, 44, 46, 48); and

[claim 54]

The steps of receiving a fluid into a housing (10A, 10B, 11) through an input line 18 and delivering the fluid through an output line 72 (col. 9 ll. 62 – col. 10 ll. 12), operating a first piston 13A in an expansion stroke and a compression stroke in a first piston chamber 12A in the housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 in fluid communication with the

input line 18 and a first outlet (34/44), wherein during the expansion stroke fluid flows into the first piston chamber 12A through the first inlet 32 and during the compression stroke the fluid is forced out through the first outlet (34/44), operating a second piston 13B in an expansion stroke and a compression stroke in a second piston chamber 12B in the housing (10A, 10B, 11), the second piston chamber 12B having a second inlet (34/46) in fluid communication with the first outlet (34/44) of the first piston chamber 12A and a second outlet 36 in fluid communication with the output line 72, wherein the second piston chamber 12B has a smaller volume than the first piston chamber 12A, wherein during the expansion stroke fluid is drawn into the second piston chamber 12B through the second inlet (34/46) and during the compression stroke the fluid is forced out through the second outlet 36 (col. 9 ll. 62 – col. 10 ll. 12), securing the first piston 13A and the second piston 13B together with a connecting member (13, 14) in a spaced apart manner along a common axis, the connecting member (13, 14) having threads (as defined by the threaded portion of element 13) along a portion of its length, operating a ball screw drive system (14, 21, 22) in communication with the threads (as defined by the threaded portion of element 13) on the connecting member (13, 14) to reciprocate the connecting member (13, 14) such that when the first piston 13A

is in an expansion stroke, the second piston 13B is in a compression stroke, and when the first piston 13A is in a compression stroke, the second piston 13B is in an expansion stroke.

(3) **Motivation for combination:** Muratsubaki '448 teaches a pump that is used to create a high pressure by routing a volume of fluid from one chamber where fluid is pressurized by a first piston traversing through a chamber in a compression stroke, to a subsequent second chamber where a second piston that is linked to the first piston traversing through the second chamber in an expansion stroke. When the compression stroke of the first piston is completed a reversible motor drives the first and second piston assembly in a second direction so that the second piston conducts a compression stroke and fluid within the second chamber is pressurized for a second time to a high pressure. Muratsubaki '448 teaches that this method of fluid pressurization eliminates unneeded fluid circulation that can lower the quality of the fluid being pumped or compressed, and reduce the time it takes for fluid to reach a target pressure (Muratsubaki – col. 2 ll. 43-51).

Richey is directed toward a method and apparatus for forming oxygen enriched gas to be store at a high pressure in a mobile storage unit (Richey – Abstract). An objective of Richey is

to be able to store high purity oxygen in a pressure vessel using a compressor with a series of pistons that compress a fluid with a first piston which then travels to a chamber of a subsequent piston to be further compressed. Richey utilizes a labyrinth of fluid passages that are used to transport fluid from one piston chamber to the next.

It is noted that in Richey the expansion stroke of each piston does not correspond directly to the compression stroke of any other piston. Muratsubaki '448 minimizes any lost motion of a first piston by using its expansion stroke to further pressurize a fluid volume through its linkage with the second piston. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an apparatus and method of pressurizing a volume of fluid, as taught by Richey, with a fluid pump in which a piston assembly with two piston heads is reciprocated by a reversible motor such that the expansion stroke of one piston corresponds the compression stroke of the second piston, as taught by Muratsubaki '448, in order to reduce the risk of negatively affecting the quality of fluid pumped while being able to pressurize the fluid to a desired pressure quickly and more efficiently by minimizing the lost motion of a pumping member (Muratsubaki '448 – col. 2 ll. 43-51).

ii. **Combination of Richey, Muratsubaki '448, Muratsubaki '372 – Variable Speed Motor:**

(1) **Muratsubaki '372** - A combination of the references teaches the limitations as discussed but fails to teach incorporating a variable speed motor as are taught by Murasukai '372 for a method for operating a pump for pressurizing a volume of fluid including the steps of:

[claims 39 and 54]

Operating a drive system including a reversible motor 7 (analogous to the servo motor 21 of Muratsubaki '448; reversible per Muratsubaki '372 - ¶ [0065]) to drive a dual piston pump 1 to reciprocate along a linear path thereby reciprocating a connecting member (connection between elements 5A and 5B within element 1) and pistons (5A, 5B) wherein the reversible motor 7 has a variable rotational speed (Muratsubaki '372 - ¶ [0067]-[0070])

(2) **Motivation for combination:** The plunger pump 10A of Muratsubaki '448 is equivalent to the plunger pump 1 of Muratsubaki '372. The pumps operate in a similar manner with the exception that the pump of Muratsubaki '372 does not teach a valve arrangement that constructively provides an intensifier as taught by Muratsubaki '448. The modification proposed would leave the pump and valve arrangement of Muratsubaki '448 as applied to

Richey unchanged but the motor and control of Muratsubaki ‘448 would be substituted and expanded by the variable speed motor 7 and proportional control module 25 of Muratsubaki ‘372.

Muratsubaki '372 teaches detecting a pressure value in a nozzle in a suspension state and operating a plunger pump at a maximum rate to quickly raise the actual pressure in the nozzle to a preset value and then continuing to operate the plunger pump at an optimum rate to maintain the pressure value at or very close to the preset value (Muratsubaki ‘372 - ¶ [0027]). This provides a similar advantage as Muratsubaki '448, however in that pump a threshold pressure can be reached quickly but the speed of the motor driving the pump cannot be varied continuously to maintain the pressure level dynamically as taught by Muratsubaki ‘372 (Muratsubaki ‘372 - ¶ [0068]).

In Richey, while a pressure in the buffer tank is not below a threshold level, the pump is operated until the pressure in a cylinder reaches a threshold high pressure level and then the pump is turned off (Richey - col. 11 ll. 38-45). A modification in which the low pressure cut-off switch of Richey was maintained but the variable speed motor of Muratsubaki ‘372 was substituted in, and the proportional control module for maintaining a high pressure by varying the speed of a variable speed motor was added to the

control of Muratsubaki ‘448 that senses a piston’s position, would teach the limitations as claimed. With this modification once the high pressure level in the cylinder was reached in Richey, just as when the desired pressure is reached in Muratsubaki '372, the control will operate the motor at an optimum rate to maintain that pressure. One of ordinary skill in the art would have found it obvious at the time the invention was made to modify an oxygen concentrator with a mobile oxygen storage unit, as taught by Richey, by substituting a compressor with an intensifier, as taught by Muratsubaki '488 and discussed above, further modified by expanding a control and substituting a motor with a proportional control module and variable speed motor respectively, as taught by Muratsubaki ‘372, in order to provide a system that could quickly provide fluid at a desired pressure in a storage cylinder and dynamically maintain the pressure in the cylinder by modulating the speed at which the motor drove the intensifier (Muratsubaki '372 - ¶ [0027], [0068]).

iii. **Combination of Richey, Muratsubaki ‘372, Murasubaki ‘488, Coffield US 5,354,361 – Fluid Path Arrangement Within Housing**

(1) **Coffield** - A combination of the references teaches the limitations as discussed but fails to teach the same type of fluid arrangement in a housing where the output of one chamber is

connected to the input of another successive chamber that is taught by Coffield in a method for operating a pump for pressurizing a volume of fluid including the steps of:

[claims 39 and 54]

providing a passage 56 coupling a first outlet 53 of a first piston chamber 42 with a second inlet 59 of a second piston chamber 43 so that the second piston chamber 43 has the second inlet 53 in fluid communication through the passage 56 with the first outlet of the first piston chamber 42, and the step wherein fluid drawn into the second piston chamber 43 is forced out of a second outlet 61 of the second piston chamber 43 to an output line 63.

(2) **Combination** –

(a) Where a claimed improvement on a device or apparatus is no more than "the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for improvement," the claim is unpatentable under 35 U.S.C. 103(a). *Ex Parte Smith*, 83 USPQ.2d 1509, 1518-19 (BPAI, 2007) (*citing KSR v. Teleflex*, 127 S.Ct. 1727, 1740, 82 USPQ2d 1385, 1396 (2007)). Wherein if applicant claims a combination that only unites old elements with no change in the respective functions of those old elements, and the

combination of those elements yields predictable results; absent evidence that the modifications necessary to effect the combination of elements is uniquely challenging or difficult for one of ordinary skill in the art, the claim is unpatentable as obvious under 35 U.S.C. 103(a). *Ex Parte Smith*, 83 USPQ.2d at 1518-19 (BPAI, 2007) (*citing KSR*, 127 S.Ct. at 1740, 82 USPQ2d at 1396.

(b) Coffield teaches it was known in the art at the time of the invention to use a dual piston intensifier pump in an oxygen concentrator of the type taught by Richey and disclosed. Coffield teaches that the dual piston pump is used as a pressure booster to provide gas at a desired higher pressure (Coffield - col. 1 ll. 13-43). A combination of the references already constructively teaches an intensifier pump with Richey which teaches smaller pump chambers in series with each other, however the chambers are not provided in the same section of a housing as taught by the dual pump of Coffield. It would have been obvious to one ordinary skill in the art at the time the invention was made to provide a connection between a first and second chamber with the same section of housing of pump and connect the outlet of chamber to the inlet of the other chamber to provide

a dual piston intensifier capable of supplying gas at elevated pressures since it was well known in the art to provide these types of pumps and pumping connections for oxygen concentrators.

(c) Accordingly, since the applicant[s] have submitted no persuasive evidence that the combination of the above elements is uniquely challenging or difficult for one of ordinary skill in the art, the claim is unpatentable as obvious under 35 U.S.C. 103(a) because it is no more than the predictable use of prior art elements according to their established functions resulting in the mere application of a known technique to a piece of prior art ready for improvement.

c. Dependent **claims 3, 9-11, 19-21, 27, 33-35, 43-45, and 50-58, 60, 62, 63, 65, and 68**

i. **Richey – claims 10, 20, 34, 44, 50-53, 55-58**

(1) Apparatus – Richey teaches all the limitations as claimed for pump including:

[claims 10 and 20]

A first pressure sensor (Richey - col. 11 16-19) for sensing fluid pressure in the first piston chamber (chamber defined by cylinder

housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5);

[claims 50 and 52]

Wherein the fluid is a gas (oxygen – Richey – col. 11 ll. 6-8); and

[claims 51 and 53]

Wherein the gas includes concentrated oxygen; (Richey – col. 11 ll. 6-8);

(2) Method – Richey teaches all the limitations as claimed for method including:

[claims 34 and 44]

The step of sensing the fluid pressure in the first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5) with a first pressure sensor (Richey - col. 11 16-19);

[claims 55 and 57]

The step of the method wherein the fluid is a gas (oxygen – Richey – col. 11 ll. 6-8);

[claims 56 and 58]

The step of the method wherein the gas includes concentrated oxygen; (Richey – col. 11 ll. 6-8);

ii. **Muratsubaki '488 – Claims 3, 9, 11, 19, 21, 27, 33, 35, 41, 43, 66, and 66:**

The combination of Richey and Muratsubaki '448 involves substituting the entire pump of Richey for the entire pump of Muratsubaki '488, therefore limitations of the following claims are taught by the combination because the pump of Muratsubaki '448 teaches the elements or method steps claimed.

(1) **Claims 3 and 27 – Threaded portion on connecting member.** The pump of Muratsubaki '448 (as applied to the oxygen storage unit of Richey) teaches the limitations including:

[claim 3]

A connecting member (13, 14) includes a threaded portion 13, the reversible motor 21 engaging the threaded portion 13, via elements 14 and 22, for alternately moving the connecting member (13, 14) in opposite directions; and

[claim 27]

The step wherein the connecting member (13, 14) includes a threaded portion (as defined by the threaded portion of element 13), the reversible motor 21 engaging the threaded portion (threaded portion of element 13), the method further comprising alternately rotating the connecting member (13, 14) in opposite directions with the reversible motor 21 (col. 10 ll. 34-50).

(2) **Claims 9, 19, 33 and 43 – Sensing a piston position.** The pump of Muratsubaki '448 (as applied to the oxygen storage unit of Richey) teaches the limitations including:

[claims 9 and 19]

A piston position sensing system (col. 14 ll. 4-12) coupled to the drive system (14, 21, 22) to detect when the pistons (13A, 13B) have reached a predetermined stroke and to reverse the drive system (14, 21, 22);

[claims 33 and 43]

The step of sensing piston position with a piston position sensing system (col. 14 ll. 4-12);

(3) **Claims 11, 21, 35, and 45 – Second pressure sensor.** The pump of Muratsubaki '448 (as applied to the oxygen storage unit of Richey) teaches the limitations including:

[claims 11 and 21]

A pressure sensor 64 for sensing the pressure of fluid expelled from the second piston chamber 12B;

[claim 35 and 45]

The step of sensing pressure of fluid expelled from the second piston chamber 12B with a pressure sensor 64;

(4) **Claims 63 and 66 – Plurality of check valves.** The pump of Muratsubaki '448 (as applied to the oxygen storage unit of Richey) teaches the limitations including:

[claim 63]

A plurality of check valves (42, 46, 48) for maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36. A pressure sensor 64 for sensing the pressure of fluid expelled from the second piston chamber 12B;

[claim 66]

The step of maintaining unidirectional flow of fluid from the first inlet 32 to the second outlet 36 using a plurality of check valves (42, 46, 48).

iii. **Muratsubaki '372 – Claims 60, 62, 65, and 68:**

The combination of Richey, Muratsubaki '448, and Muratsubaki '372 involves substituting the motor of Muratsubaki '488 with variable motor of Muratsubaki '372 and expanding the control of Muratsubaki '488 with proportional control module of Muratsubaki '372 for operating a variable speed motor at an optimum rate that will vary once a pressure level is reached as a result of system conditions.

(1) **Claims 60, 62, 65, and 68 - Varying speed during piston cycle.** The proportional control module of Muratsubaki '372 enables dynamic control of the speed of the motor dependent upon system

conditions while the motor is drives a plunger pump (Muratsubaki '372 - ¶ [0068]). The dynamic control Muratsubaki will result the speed of the motor changing while a piston is in an intermediate portion of its stroke. Therefore the combination, with respect to the contributions of the proportional control module of Muratsubaki '372, teaches the limitations for a pump including:

[claims 60 and 65]

Wherein the rotation speed of a motor 7 varies during a piston cycle (Muratsubaki '372- ¶ [0068]);

[claims 62 and 68]

The step wherein the rotation speed of a motor 7 is varies during a piston cycle (Muratsubaki '372- ¶ [0068]).

6. Claims 12-13, 22-23, 36-37, and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey view of Muratsubaki '448, Muratsubaki '372, and Coffield, as applied to claims 15, 39, 49, and 54 above in section 5 of this office action. A combination of the references teaches the general conditions of the claimed invention except for the express disclosure of an apparatus for accomplishing a method of compressing fluid including: **[claims 12, 22, 36, and 46]** a ratio of the volume of a first piston chamber to the volume of a second piston chamber is about 12.5 to 1.0; **[claims 13, 23, 37, and 47]** and first and second pistons have a stroke of about 6 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made to alter the ratio between first and second pumping chambers to be in the

range of 12.5 to 1 and a piston stroke being about six inches, since the claimed values are merely an optimum or workable range. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

7. Claims 14, 24, 38, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey view of Muratsubaki '448, Muratsubaki '372, and Coffield, as applied above to claims 13, 24, 37, and 47 in section 6 of this action. A combination of the references teaches the claimed invention except for the limitation of **[claims 14, 24, 38, and 48]** a pump being capable of pumping about 0.5 in.3 of gas at about 2200 psi per piston cycle. The volume of a discharged portion of fluid from a pump and the pressure at which it is discharged is a results effective variable with the results being 0.5 in.3 of gas at about 2200 psi per piston cycle. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a pump that was capable of pumping 0.5 in.3 of gas at about 2200 psi per piston cycle, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

8. Applicant's arguments with respect to claims 3, 9-15, 19-24, 27, 33-39, and 43-58, 60, 62, 63, 65, 66, and 68 have been considered but are moot in view of the new ground(s) of rejection. With respect to applicant's argument that combination of references does not teach a pump that operates in response to the pressure input at the first stage. While making this argument the applicant also states that "Richey's pump

operates at 50 rpm until the input pressure drops below a threshold level, at which point the pump stops." Amendment, pg. 14, 4th paragraph. However the examiner notes that Richey disclose that "[i]f the input pressure to the compressor rises above a desired predetermined pressure, low pressure switch 660 will close and once again turn on the solid-state relay and start the motor." Richey, col. 11 ll. 67 – col. 12 ll. 5. When the motor starts it initiates the operation of the pistons in the pump of Richey. Therefore Richey teaches an operation of initiating a compression stroke in response to the input pressure of the compressor taught by Richey.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEONARD J. WEINSTEIN whose telephone number is (571)272-9961. The examiner can normally be reached on Monday - Thursday 7:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on (571) 272-7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art Unit 3746

/Leonard J Weinstein/
Examiner, Art Unit 3746